

AMENDMENTS TO THE CLAIMS

The following listing of claims will replace all prior versions and listings of claims in the application.

LISTING OF CLAIMS

1. (previously presented) An electronic control system for use in a riveting process, the system comprising:

an electronic control unit;

an electric motor connected to the electronic control unit;

a first sensor connected to the electronic control unit and the electric motor, the first sensor being operable to indicate at least one of: (a) torque of the electric motor, (b) speed of the electric motor, and (c) an electrical power characteristic of the electric motor; and

at least a second sensor connected to the electronic control unit, the second sensor operably detecting a riveting characteristic occurring during the riveting process, the riveting characteristic consisting essentially of at least one of: (a) riveting force, (b) rivet punch assembly location, (c) rivet size, and (d) workpiece thickness;

the electronic control unit automatically varying the riveting process in a real-time manner in response to output from at least the first and second sensors.

2. (original) The system of Claim 1 further comprising a rivet and a riveting machine which includes the electric motor, the riveting machine operably moving the rivet.

3. (original) The system of Claim 2 further comprising:

a rivet feeder having an actuator connected to the electronic control unit;

and

a feed tube sensor connected to the electronic control unit;

wherein the electronic control unit operably controls feeding of the rivet by the feeder during the riveting process and the feed tube sensor sends a signal to the electronic control unit indicative of the presence of the rivet.

4. (previously presented) The system of Claim 1 further comprising a

punch and a fluid-free transmission, the transmission being operable to convert rotary motion of the electric motor to linear motion driving the punch, the transmission always being coupled to the electric motor and the punch always being coupled to the transmission during electric motor actuation.

5. (original) The system of Claim 4 wherein the transmission includes

a closed loop belt.

6. (original) The system of Claim 1 wherein the riveting characteristic

sensed by the second sensor is the riveting force.

7. (original) The system of Claim 1 wherein the riveting characteristic

sensed by the second sensor is the rivet punch assembly location.

8. (original) The system of Claim 1 wherein the riveting characteristic sensed by the second sensor is a rivet size.

9. (original) The system of Claim 1 wherein the riveting characteristic sensed by the second sensor is a workpiece thickness.

10. (original) The system of Claim 1 wherein the second sensor is a load cell operably indicating a linearly moving member force.

11. (original) The system of Claim 1 wherein the second sensor is a proximity switch.

12. (currently amended) A riveting electrical control system comprising:

- (a) an electrical control unit;
- (b) an electric motor connected to the electrical control unit;
- (c) a fluid-free transmission operably driven by energization of the electric motor;
- (d) a riveting punch operably advanced by the transmission; and
- (e) a sensor connected to the electrical control unit, the sensor being operable to sense riveting force; and
- (f) a second riveting characteristic sensed in real-time for use by the electrical control unit.

13. (currently amended) A riveting electrical control system comprising:

- (a) an electrical control unit;
- (b) an electric motor connected to the electrical control unit;
- (c) a fluid-free transmission operably driven by energization of the electric motor;
- (d) a riveting punch operably advanced by the transmission;
- (e) a sensor connected to the electrical control unit, the sensor being operable to sense riveting force; and

(f) ~~The system of Claim 12 further comprising a rivet operably driven by the punch, the electrical control unit automatically varying a characteristic associated with the punch in response to the sensed riveting force.~~

14. (original) The system of Claim 13 further comprising:

a rivet feeder having an actuator connected to the electronic control unit;
and

a feed tube sensor connected to the electronic control unit;

wherein the electronic control unit operably controls feeding of the rivet by the feeder during the riveting process and the feed tube sensor sends a signal to the electronic control unit indicative of the presence of the rivet.

15. (original) The system of Claim 12 wherein the transmission operably converts rotary motion of the electric motor to linear motion for moving the punch.

16. (original) The system of Claim 15 wherein the transmission includes a closed loop belt.

17. (currently amended) The system of Claim 12 13 wherein a second riveting characteristic is sensed in real-time for use by the electrical control unit.

18. (currently amended) The system of Claim 12 further comprising a second sensor operably sensing the second riveting characteristic which is an electrical power characteristic of the electric motor.

19. (currently amended) The system of Claim 12 further comprising a second sensor operably sensing the second riveting characteristic which is a speed of the electric motor.

20. (currently amended) The system of Claim 12 further comprising a second sensor operably sensing the second riveting characteristic which is a torque of the electric motor.

21. (original) The system of Claim 12 wherein the electric control unit is a programmable computer.

22 – 77 (cancelled).

78. (new) The system of Claim 13 wherein the transmission operably converts rotary motion of the electric motor to linear motion for moving the punch.

79. (new) The system of Claim 78 wherein the transmission includes a closed loop belt.

80. (new) The system of Claim 13 further comprising a second sensor operably sensing an electrical power characteristic of the electric motor.

81. (new) The system of Claim 13 further comprising a second sensor operably sensing speed of the electric motor.

82. (new) The system of Claim 13 further comprising a second sensor operably sensing torque of the electric motor.

83. (new) The system of Claim 13 wherein the electric control unit is a programmable computer.

84. (new) The system of Claim 13 further comprising a die operably diverging an end of the rivet without the rivet piercing completely through an exterior surface of a die-side workpiece adjacent the die, the rivet being a self-piercing rivet.

85. (new) The system of Claim 12 further comprising:
a self-piercing rivet driven by the punch; and
a die operably diverging an end of the rivet without the rivet piercing completely through an exterior surface of a die-side workpiece adjacent the die.

86. (new) The system of Claim 1 further comprising:
a self-piercing rivet driven in response to actuation of the electric motor; and
a die operably diverging an end of the rivet without the rivet piercing completely through an exterior surface of a die-side workpiece adjacent the die.